Designing an Evidence Based Medicine Resource Page to Help Student Pharmacists

Michael Griggs BS Candidate, Debra Barnette PharmD, FCCP, BCPS, BCACP, CDE, Natalie Kupferberg* BSN, MLS

The Ohio State College of Pharmacy, Columbus, OH

* The Ohio State University Libraries, Columbus, OH

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Michael Griggs
500 W 12th Ave
Columbus, OH 43210
614-247-6198
griggs.83@osu.edu

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INTRODUCTION

In a 1996 *British Medical Journal* editorial, David Sackett defined Evidence Based Medicine (EBM) as "the conscientious, explicit and judicious use of current best evidence in making decisions about the care of the individual patient. It means integrating individual clinical expertise with the best available external clinical evidence from systematic research" [1]. Regardless of practice setting, EBM is an essential skill for all pharmacists so they can provide optimal, individualized patient care. Within the healthcare team, pharmacists are the experts in the therapeutic use of medications and can prevent medication errors by providing evidence-based recommendations at the onset of prescribing [2].

EBM plays an important role in the new 2016 Accreditation Standards for pharmacy schools issued by the Accreditation Council for Pharmacy Education. Required curriculum elements include application of relevant health literature and other information resources to answer specific patient care questions, and providing evidence-based therapeutic recommendations to health care providers. The Institute of Medicine also calls for the employment of evidence-based practice to improve medication safety and patient outcomes [3]. It is essential to assess our current position with regards to these standards to best formulate a plan for achievement.

Given the importance of attaining new accreditation standards as well as training students for advanced clinical practice, our global goal is to increase the awareness and utilization of EBM by Ohio State University College of Pharmacy (OSU COP) students throughout their education and careers. There are many difficult but necessary steps in practicing EBM. These include: asking the right clinical question, locating appropriate resources, comprehending terminology and statistics, efficiently appraising articles, interpreting information confidently and correctly, and finally integrating with existing pharmacotherapy knowledge. With over two million scientific articles published each year [4], staying abreast of the new evidence while practicing full time is an additional challenge as well as finding time to search for relevant articles on specific patient cases [5]. Bringing EBM focused resources together in a concise, easily accessible web-based format seemed a potentially beneficial educational and clinical tool for student pharmacists.

Two of the authors, a pharmacy faculty member and a second-year (P2) post-BS PharmD student suggested creating an evidence based medicine resource page to the other author, a pharmacy subject librarian, as an addition to a highly utilized subject guide on drug information resources. The Ohio State University Libraries (OSUL) is the 15th largest university library in North America, with a collection of over 8 million volumes [6] serving over 58,000 students [7]. A major component of the OSUL website is a collection of subject guides using the content management system LibGuides. Although Ohio State originally geared the subject guides for undergraduates unfamiliar with doing research in an area, the scope has expanded to include specific course guides as well as specialized subjects tailored for graduate students such as "geodetic science" or "Andean and Amazonian Information Resources." Librarians can create a guide on any topic they feel is pertinent to their patrons and often collaborate with teaching faculty.

This manuscript will describe the EBM resource page design, development and related faculty survey. Faculty input would be critical to the page development and future utilization of the resource.

METHODS

Resource Page Design

Work on the evidence-based medicine page began March 2015. The initial working group included a pharmacy subject librarian, a health sciences librarian with EBM expertise, a board-certified pharmacotherapy specialist faculty member, and a P2 PharmD student.

From this working group, four goals for the EBM subject page were identified: 1) provide a concise introduction to EBM principles, 2) offer specialized EBM resource links (both freely available and those OSU subscribes to), 3) provide links to useful current awareness sources, and 4) create a comprehensive educational tool.

An EBM overview was included to provide students with additional information to refresh and supplement material presented during the first-year (P1) drug information module. Internet accessible links that were succinct and inclusive, as well as user friendly, were prioritized for inclusion. For students who prefer something more concise than a tutorial, links were provided to introductory articles from *U.S.*

Pharmacist [8], and the *Annals of Pharmacotherapy* [9] which give basic, pharmacy specific definitions as many introductions to EBM provide a wider discussion for the intended audience. Links to EBM glossaries were included to provide accurate descriptions of statistical and EBM terminology appearing in clinical literature. For an in-depth topic review, a link to *JAMA Evidence* [10] was added which includes the full text of three evidence based medicine textbooks.

Almost all introductions to evidence based resources include a visual representation of EBM, usually in the shape of a pyramid displaying a hierarchy of the different levels of evidence based on the inherent strengths and weaknesses of each study design (e.g., case reports are considered a lower level of evidence than randomized controlled trials). However, there is considerable variation in these pyramids, with some using research design types and others actually listing the resource (e.g., Cochrane Library). Since every healthcare and academic institution has access to different resources, a pyramid that lists specific resources appeared less useful. We decided to use a version of the pyramid copyrighted by the trustees of Dartmouth College and Yale University [11] which was created by the medical illustrator at the OSU Health Science Library. This pyramid focuses on strengths of research study designs for clinical application; information highly stressed in pharmacy education and in practice.

We decided to include some EBM focused resources that OSUL does not subscribe to, particularly when it came to pre-appraised tools and current awareness. Ohio State, like any other university, cannot afford every valuable resource, and libraries frequently decide on subscriptions with input from teaching faculty members. If we only included resources where all sections were available to OSU patrons, students might miss many excellent "foraging" tools – tools that alert researchers to information which the researcher can then pursue, as distinct from "hunting" tools which focus on immediately answering the question being investigated [12]. "Foraging" tools are especially useful in alerting subscribers to new information – as a way of staying up to date. Often the foraging part of the database is free. The concepts of "foraging" and "hunting" are instrumental in developing students' life-long learning skills.

Links to current awareness resources were also made available to help students stay aware of new clinical trials and EBM publications. *NEJM Journal Watch*, *iForumRx*, *Evidence Updates*, and *DynaMed EBM Focus* were all included. Many of these resources will send emails with curated trial selections and pre-appraised reviews. These are great resources for students to gain clinical insight from experts in the field and to learn how to apply trial results to clinical practice. In summary, the design and development of the EBM resource page addresses applications in the classroom, clinical rotations and beyond pharmacy school education.

Faculty Survey (Appendix A)

OSU COP faculty members and teaching residents were selected to complete the survey as they could provide subjective assessments of current fourth-year (P4) students' EBM classroom competency and observed EBM competency on APPE (Advanced Pharmacy Practice Experience) rotations. In addition, they could also provide feedback about the clinical and educational benefit of the resource page from their years practicing as a clinical pharmacist and teaching pharmacy students. Participants identified to complete the survey included the OSU COP drug information specialist as well as OSU COP full time faculty members and first and second year Ambulatory Care residents with both didactic teaching and APPE precepting responsibilities.

The primary objectives of the faculty survey were to: 1) assess potential educational and clinical benefit of the EBM resource page, 2) subjectively assess current faculty perceptions of P4 student EBM knowledge and skill, 3) identify potential areas to improve student pharmacists' knowledge and skill, and 4) identify current OSU COP faculty EBM applications.

The faculty survey was divided into three sections. The first section evaluated perceptions of P4 students' EBM knowledge at the completion of their APPE year, including ability to understand EBM terminology, application of EBM concepts to patient care, ability to concisely discuss EBM and clinical trials with providers, and familiarity with EBM focused resources. The next section of the survey focused on assessing the usefulness of the EBM resource page. Faculty members/residents responded about the resource page's ability to describe EBM principles, ability to identify useful EBM resources, ease of

navigation and overall clinical and educational value. The final section collected respondent demographic information as well as inclusion of EBM into lectures and discussion on rotations with students, level of direct patient care responsibilities, and formal EBM training. A standard 5-point Likert scale (1= strongly disagree, 2= disagree, 3= neutral, 4= agree, 5= strongly agree) was utilized to quantify responses when applicable.

The survey was reviewed by OSU COP faculty (n=3) who were not participating in the survey before distribution. Feedback was provided on survey statements to ensure consistent interpretation amongst respondents.

The survey with resource page link was distributed electronically to 15 OSU COP members via "Top Hat"[13] June 2015. Responses were de-identified and reported in aggregate to provide anonymity for respondents. This was granted approval from The Ohio State University IRB (2015E0476) as exempt.

RESULTS

The resource page launched university wide in the summer of 2015 (http://guides.osu.edu/pharmacy/EBM). Of the 15 OSU COP faculty/residents that met the inclusion criteria, 12 completed the survey (80% response rate). All 12 responses were analyzed including six full time faculty, five Ambulatory Care residents and one unknown as they did not provide demographic data (Table 1). Forty-five percent of respondents (5/11) had greater than 10 years teaching and precepting experience. Half of respondents (5/10) spend greater than 50% of their time in direct patient care responsibilities. Three respondents (3/11) were board certified pharmacotherapy specialists. Ninety percent (9/10) agreed or strongly agreed that they discuss relevant trials and EBM literature with their students on APPE rotations.

Despite 64% (7/11) of respondents having formal EBM training in the form of an online class or in a classroom, 100% (11/11) of the faculty/resident respondents would welcome additional training in EBM. When searching for EBM information, faculty members/residents reported exclusively using *PubMed* (11/11, 100%) most often versus more EBM focused resources such as *Cochrane Library* (3/11, 27%) or the *National Guideline Clearinghouse* (1/11, 9%).

When queried specifically about P4 students' EBM knowledge and skill at the end of APPE rotations, a majority of the responses to the survey questions were neutral (Table 2). Despite 50% (6/12) of respondents agreeing that P4 students understand terminology related to EBM, only 36% (4/11) agreed that the students can apply EBM concepts to patient care with 27% (3/11) disagreeing that students can apply EBM concepts to patient care. Twenty-seven percent (3/11) of the faculty respondents agreed that students were able to concisely discuss EBM/trials with providers while 36% (4/11) disagreed. Only 17% (2/12) of the faculty members agreed that P4 students were familiar with EBM focused resources besides *Pubmed* and no one strongly agreed. A majority of the faculty/residents agreed that students could identify drug information resources effectively (67%, 8/12) as well as critically appraise articles for applicability to patient care (58%, 7/11). Ninety-one percent (10/11) of respondents agreed or strongly agreed that students would benefit from more EBM training in terminology, resources, concepts and application to patient care.

With regards to the assessment of the online EBM resource page, all respondents agreed or strongly agreed that the resource page is a beneficial clinical (12/12) and educational tool (11/11) (Table 3). Eighty-four percent (10/12) of respondents agreed or strongly agreed that the resource page identifies the most commonly used EBM resources and 100% (12/12) of respondents agreed or strongly agreed that the resource page identifies useful EBM resources. The website was viewed positively for its description of EBM principles and overall ease of navigation with 83% (10/12) and 82% (9/11) agreeing or strongly agreeing with these statements respectively.

DISCUSSION

The online library EBM resource page has been well received by our College faculty for its clinical and educational value since its launch. The resource page can potentially remove a significant barrier to practicing EBM by providing students a place to start searching more EBM focused resources to optimize patient treatment as students are not familiar with EBM focused resources. After launch, the resource page was introduced in a new two part EBM lecture series within the P1 drug information module to increase the knowledge of EBM and to highlight its importance. The information presented

during the EBM lecture series can build upon students' strong drug information skills to become even better medication experts. Our faculty survey identified areas of strength in student pharmacist drug information skills as well as opportunities to improve our curriculum to meet newly released accreditation standards.

Bookstaver et al, at the South Carolina College of Pharmacy created an EBM elective course and demonstrated that pharmacy students became better at evaluating medical literature carefully and applying the knowledge in making patient care decisions compared to students who were not enrolled in the elective [14]. New elective classes and educational tools such as resource pages can build upon material presented during drug information modules as well as increase the awareness and utilization of EBM by student pharmacists. Current awareness resources, such as *DynaMed* can provide clinical insight to future practitioners and even help faculty stay informed of "trials most likely to change clinical practice" [15].

Our survey revealed opportunities within the curriculum to improve P4 student EBM skill and application to patient care as many of the related responses were neutral. A recent study involving dental students found that concepts and skills presented during a first year drug information course were lost by the third year when students were required to evaluate therapies [16]. These important principles need to be incorporated in all facets of pharmacy education, modeled by faculty during lectures, reinforced in workshops and discussed on experiential rotations. College faculty must display an understanding of EBM related accreditation standards and develop related learning objectives to ensure their attainment.

With the expanding role of pharmacists in patient care, student pharmacists need to develop evidence based clinical reasoning skills and efficient searching abilities to overcome the many challenges of using EBM to truly become the medication experts of the healthcare team. Articulate communication of clinical trial details, guidelines and other EBM related information are the foundation of therapy discussions with other healthcare team members. This communication requires high aptitude in the interpretation of medical literature and principles of pharmacotherapy. With a majority of our faculty members discussing relevant clinical trials and EBM literature with P4 students on APPE rotations,

educational activities need to be developed throughout the curriculum to model these important interactions allowing students to build the necessary skills for use on experiential rotations and in practice.

Despite a limited clinical faculty cohort to provide survey responses, a large number had taught and trained APPE students for greater than 10 years. This adds considerable strength to the general survey observations regarding the resource comprehensiveness, utility, educational benefits and student skill level. At this point in the curricular revision process, assessment of faculty perceptions of P4 students' EBM competency provides formative feedback to direct changes to meet the 2016 EBM related accreditation standards.

With the expanding integration of pharmacists in patient care teams, expert knowledge and utilization of EBM is essential. There are many complex aspects involved in developing sound student EBM application skills, and the development of new tools such as an online resource page is an initial step to compliment developing drug information searching skills. Creation of an EBM resource page can be easily reproduced at other institutions, tailored to fit specific student needs and resource subscriptions. Increasing the awareness and utilization of EBM will strengthen the quality of treatment recommendations that student pharmacists can provide. Our survey revealed areas of strength in our doctor of pharmacy curriculum as well as areas for improvement. By increasing the incorporation of EBM and its principles into all aspects of pharmacy education we can best train student pharmacists for advanced clinical practice.

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Table 1: Information about OSU COP faculty and resident respondents.

Table 1: OSU COP Clinical Faculty/Resident respondent information (n=11)			
OSU COP Full time practice based faculty with APPE precepting responsibilities	6		
OSU COP Ambulatory Care Residents with precepting responsibilities	PGY-1 3	PGY-2 2	
Board Certified Pharmacotherapy Specialist	Yes 27% (3)	No 73% (8)	
% of time in direct patient care responsibilities[d]	(>25%) 80% (8)	(>50%) 50% (5)	
Years teaching or precepting OSU COP students	(<5) 45% (5)	(5 – 10) 9% (1)	(>10) 45% (5)
Resources used most often for EBM information	Pubmed 100% (11)	Google Scholar 9% (1)	Others – Cochrane 27% (3)
Had formal EBM training	Yes 64% (7)	No 36% (4)	
I feel very comfortable using EBM resources in determining patient treatment[d]	Yes 70% (7)	No 30% (3)	
Would welcome additional EBM training	Yes 100% (11)		
Frequently apply EBM principles in my current practice[c,d]	Agree or Strongly Agree 70% (7)	Neutral 10% (1)	Disagree 10% (1)
Often discuss relevant trials and EBM with students on my rotation[d]	Agree or Strongly Agree 90% (9)	Neutral 10% (1)	
Often discuss relevant trials and EBM during my lectures[d]	Agree 60% (6)	Neutral 10% (1)	Neutral 30% (3)
Resources used most often for EBM information	Pubmed 100% (11)	Google Scholar 9% (1)	Others – Cochrane 27% (3)
[c]: 1 no response [d]: 1 not applicable			

Table 2: Perceptions of current EBM knowledge and skills of OSU COP P4 students
SD: strongly disagree, D: disagree, N: neutral, A: agree, SA: strongly agree

Table 2: Perceptions of current EBM knowledge and skills of OSU COP P4 students (n=12)	**1 SD % (n)**	**2 D % (n)**	**3 N % (n)**	**4 A % (n)**	**5 SA % (n)**
Consistently demonstrate understanding of terminology related to EBM (i.e.: PICO, NNT, NNH, ARR, RRR, concealed allocation…)	8 (1)	25 (3)	17 (2)	50 (6)	
Can apply concepts related to EBM (i.e.: PICO, NNT, NNH, ARR, RRR, concealed allocation…) to patient care [a]		27 (3)	36 (4)	36 (4)	
Are familiar with EBM focused resources (i.e., Cochrane reviews, DynaMed, JAMA Evidence, ACP Journal Club, …)	8 (1)	50 (6)	25 (3)	17 (2)	
Effectively identify pertinent drug information resources to answer general clinical questions		17 (2)	17 (2)	67 (8)	
Can identify clinical questions which require implementing EBM principles beyond clinical practice guidelines (i.e.: recently published clinical trials) [a]	9 (1)	18 (2)	27 (3)	45 (5)	
Often rely solely on clinical practice guidelines to answer clinical questions [a]		25 (3)	33 (4)	25 (3)	8 (1)
Can conduct very effective literature searches for answers to therapeutic questions		17 (2)	50 (6)	33 (4)	
Can critically appraise articles for applicability to patient care		8 (1)	33 (4)	58 (7)	
Effectively utilize EBM to guide drug therapy selections [a]	9 (1)	27 (3)	36 (4)	9 (1)	18 (2)
Can concisely discuss EBM/trials with providers [a]		36 (4)	36 (4)	27 (3)	
Would benefit from more training in evidence based medicine concepts [a]			9 (1)	27 (3)	64 (7)
Would benefit from more training in applying evidence based medicine to patient care [a]			9 (1)	27 (3)	64 (7)
[a]: 1 no response, % based on n=11					

Table 3: Assessment of the overall usefulness of the EBM resource page as perceived by the faculty/resident respondents

SD: strongly disagree, D: disagree, N: neutral, A: agree, SA: strongly agree

Table 3: Opinions about the EBM resource page: (n=12)	**1 SD % (n)**	**2 D % (n)**	**3 N % (n)**	**4 A % (n)**	**5 SA % (n)**
Describes/clarifies EBM principles		8 (1)	8 (1)	58 (7)	25 (3)
Can help identify useful EBM library resources				50 (6)	50 (6)
Identifies the most commonly used resources			17 (2)	42 (5)	42 (5)
Is easily navigated [b]			18 (2)	45 (5)	36 (4)
Is a beneficial educational tool				42 (5)	58 (7)
Is a beneficial clinical tool [b]				55 (6)	45 (5)
[b]: 1 no response, % based on n=11					

Appendix A – Faculty/Resident Surveys

Section 1: Perceptions of current EBM knowledge and skills of our P4 year students.

In your opinion, at the completion of the P4 year students:

a. Consistently demonstrate understanding of terminology related to EBM (ie: NNT, NNH, ARR, RRR…)
b. Can apply concepts related to EBM (ie: NNT, NNH, ARR, RRR…) to patient care
c. Are familiar with EBM focused resources (ie: Crochrane reviews, DynaMed, JAMA Evidence, ACP Journal Club…)
d. Effectively identify pertinent drug information resources to answer general clinical questions.
e. Can identify clinical questions which require implementing EBM principles beyond clinical practice guidelines (ie: recently published clinical trials)
f. Can conduct effective literature searches for answers to therapeutic questions
g. Often rely solely on clinical practice guidelines to answer clinical questions
h. Can critically appraise articles for applicability to patient care
i. Effectively utilize EBM to guide drug therapy selections
j. Can concisely discuss EBM/trials with providers
k. Would benefit from more training in evidence based medicine concepts
l. Would benefit from more training in applying EBM to patient care

Section 2: Assessment of the overall usefulness of the EBM website

In your opinion, the EBM website

a. Describes/clarifies EBM principles
b. Can help identify useful EBM library resources
c. Identifies the most commonly used resources
d. Is easily navigated
e. Is a beneficial clinical tool
f. Is a beneficial educational tool
g. Please provide additional comments/suggestions_____

Section 3: Demographics - Please rate your agreement with the following statements based on the following: 1.Strongly Disagree 2. Disagree 3. Neutral 4. Agree 5. Strongly Agree

a. I often discuss relevant trials and EBM literature in my lectures.
b. I often discuss relevant trials and EBM literature with the students on my rotations
c. I frequently apply EBM principles in my current practice.
d. I feel very comfortable using EBM resources in determining patient treatments
e. I have direct patient care responsibilities in my practice. Y N

i. If yes, what percentage is spent in patient care? Circle response

< 10% 11%- 25% 26% - 50% 51% - 75% > 75%

f. Please circle the resources you use MOST often for EBM information
   i. PubMed searches
   ii. OvidMedline
   iii. DynaMed
   iv. Cochrane Library of resources
   v. ACP Journal Club
   vi. Others-

g. I have had formal training in EBM (Y/N)
   i. Classes or Online course
   ii. Within past 5 years (Y/N)

h. I would welcome more EBM training (Y/N)

i. I have been teaching or precepting at Ohio State University College of Pharmacy for ____ years. < 5 years 5 - 10 years > 10 years

j. Which of the following best describes you current position? Please circle
   i. OSU faculty member
   ii. Pharmacy practice resident

k. My final terminal degree was achieved in ____.

Before 1990 1990-1995 1996-2000 2001-2005 2006-2010 after 2011

l. Are you a Board Certified Pharmacotherapy Specialist? (Y/N). If yes, please identify your specialty.

m. Do you subscribe to any current awareness emails/alerts? (Y/N)

DynaMed, Medscape, JAMA alerts, Journal Watch, iForumRX , others_____